Speed Test-50

1. **(b)** Mn - $3d^5 4s^2$ $\boxed{1}\boxed{1}\boxed{1}\boxed{1}\boxed{1}$ $\boxed{1\downarrow}$

The no. of various oxidation states possible are +2, + 3, + 4, + 5, + 6 and + 7.

2. **(b)**

3. **(c)** The number of unpaired electrons in $Ni^{2+}(aq) = 2$

Water is weak ligand hence no pairing will take place

spin magnetic moment

$$= \sqrt{n(n+2)} = \sqrt{2(2+2)} = \sqrt{8} = 2.82$$

4. **(b)**

5. **(d)** $(n-1)d^5 ns^2$ attains the maximum O.S. of + 7.

6. **(c)**

7. **(a)** $Mn^{2+} = 3d^5$ i.e. no. of unpaired $e^- = 5$

$Cu^{2+} = 3d^9$ i.e. no. of unpaired $e^- = 1$

$Fe^{2+} = 3d^6$ i.e. no. of unpaired $e^- = 4$

$Zn^{2+} = 3d^{10}$ i.e. no. of unpaired $e^- = 0$

$Ni^{2+} = 3d^8$ i.e. no. of unpaired $e^- = 3$

Higher the number of unpaired electrons higher will be the magnetic moment. Hence Mn^{2+} having maximum unpaired electrons will have the maximum magnetic moment.

8. **(a)** Given magnetic moment of transition metal

$$= \sqrt{n(n+2)} = 5.92$$

i.e., n = 5

Number of unpaired electrons in $Mn^{2+} = 5$

Number of unpaired electrons in $Ti^{3+} = 1$

Number of unpaired electrons in $Cr^{3+} = 3$

Number of unpaired electrons in $Cu^{2+} = 1$

Number of unpaired electrons in $Co^{2+} = 3$

Thus Mn^{2+} have magnetic moment = 5.92 BM

9. **(a)** Zn, Cd and Hg due to presence of completely filled *d*-orbitals in ground state as well as in their common oxidation states are not regarded as a transition metals but they are studied along with the transition metals.

10. **(d)** Super conductors are derived from compounds of transition metals.

11. **(a)** Electronic configuration of Mn is $[Ar]3d^5 4s^2$. Being transition metal it has 7 valence electrons and all are involved in bond formation in MnO_4^-. Hence it has no unpaired electron

12. **(d)** Mischmetall consists of a lanthanoid metal (~95%) and iron (~ 5%) and traces of S,C,Ca and Al.

13. **(a)** $Tb^{4+} = 4f^7$ — 3 unpaired e^-

$Lu^{3+} = 4f^{14}$ — 0 unpaired e^-

$Ce^{4+} = 4f^0$ — 0 unpaired e^-

$La^{3+} = 4f^0$ — 0 unpaired e^-

14. **(b)** In neutral or faintly alkaline medium thiosulphate is quantitatively oxidized by $KMnO_4$ to SO_4^{2-}

$$8KMnO_4 + 3Na_2S_2O_3 + H_2O \longrightarrow 3K_2SO_4 + 8MnO_2 + 3Na_2SO_4 + 2KOH$$

15. **(a)** They contain different percentage of carbon.

16. **(b)** In vertice columns of transition elements, there is an increase in size from first member to second member as expected but from second member to third member, there is very small change in size and some times sizes are same. This is due to lanthanide contraction. This is the reason for Zr and Hf to have same radius.

17. **(b)** HCl and SO_2 are reducing agents and can reduce MnO_4^-. CO_2 which is neither oxidising and nor reducing will provide only acidic medium. It can shift reaction in forward direction and reaction can go to completion.

18. **(b)** Mn^{2+} (d^5) is more stable than Mn^{3+} (d^4), thus

$$E^\circ_{Mn^{3+}/Mn^{2+}} = +ve$$

19. **(a)** Green vitrol is $FeSO_4.7H_2O$.

20. **(a)** $Cr_2O_7^{2-} + 6e^- + 14H^+ \rightarrow 2Cr^{3+} + 7H_2O$

$Sn^{2+} \rightarrow Sn^{4+} + 2e^-$

one mole of Sn^{2+} provide 2 mole of e^- which will reduce $1/3 Cr_2O_7^{2-}$.

21. **(c)** $E^\circ_{Cu^{+2}/Cu} = 0.34\,V$

other has – ve $E^\circ_{R.P.}$

$E^\circ_{Co^{2+}/Co} = -0.28\,V$

$E^\circ_{Ni^{2+}/Ni} = -0.25\,V$

$E^\circ_{Fe^{2+}/Fe} = -0.44\,V$

22. **(b)** In lanthanides, there is poorer shielding of 5*d* electrons by 4*f* electrons resulting in greater attraction of the nucleus over 5*d* electrons and contraction of the atomic radii.

23. **(c)** $AgCl(s) + 2NH_4OH(aq) \rightarrow$

$$\left[Ag(NH_3)_2\right]Cl(aq) + 2H_2O(l)$$

24. **(d)** (i) Haematite is Fe_2O_3 in which Fe is present in III oxidation state.

(ii) Magnetite (Fe_3O_4) is an equimolar mixture of FeO and Fe_2O_3.

Oxidation state of Fe in FeO is II.

Oxidation state of Fe in Fe_2O_3 is III.

25. **(b)** $1M\,KMnO_4 \equiv 5N\,KMnO_4 \equiv 5N\,FeSO_4$

$\therefore 10 \times 1M \equiv 10 \times 5N \equiv 10 \times 5N$

$KMnO_4 \quad KMnO_4 \quad FeSO_4$

26. **(b)** Eu^{2+} has electronic configuration $[Xe]4f^7$ hence stable due to half filled atomic orbitals.

27. **(b)** $H_2Cr_2O_7 + 4O \rightarrow \underset{\text{Blue peroxide of chromium}}{2CrO_5} + H_2O$

28. **(c)** Both MnO_2 and $KMnO_4$ used for the preparation of chlorine by the action of conc. HCl

$MnO_2 + 4HCl \rightarrow MnCl_2 + 2H_2O + Cl_2$

$2KMnO_4 + 16HCl \rightarrow 2KCl + 2MnCl_2 + 8H_2O + 5Cl_2$

Chlorine is not obtained by dil HCl

29. **(a)** $2KMnO_4 + H_2SO_4\,(conc.) \rightarrow \underset{\text{Explosive}}{K_2SO_4 + Mn_2O_7} + H_2O$

30. **(b)** In any row the melting points of transition metals rise to a maximum at d^5 except for anomalous values of Mn and Tc and falls regularly as the atomic number increases.

31. **(c)** In laboratory, manganese (II) ion salt is oxidised to permagnate ion in aqueous solution by peroxodisulphate.

$2Mn^{2+} + \underset{\text{peroxodisulphate ion}}{S_2O_8^{2-}} + 8H_2O \rightarrow 2MnO_4^- + 10SO_4^{2-} + 16H^+$

32. **(a)** In interstitial compounds small atoms like H, B and C enter into the void sites between the packed atoms of crystalline metal. They retain metallic conductivity and are chemically inert.

33. **(d)**

Eu	La	Gd	Am
O.S = +2, +3	+3	+3	+4, +5, +6

34. **(b)** $2MnO_2 + 4KOH + O_2 \longrightarrow \underset{\text{dark green}}{2K_2MnO_4} + 2H_2O$

35. **(b)** $Ag_2S + 4NaCN + 2O_2 \longrightarrow 2Na[Ag(CN)_2] + Na_2SO_4$

36. **(b)** Ferrous ferricyanide is known as Turbull's blue.

37. **(b)** Oxidation of water takes place in presence of Mn in biological process.

38. **(b)** As a result of lanthanide contraction Zr^{4+} and Hf^{4+} possess almost the same ionic radii. Ce^{4+} is an oxidising agent. Ce^{4+} gains electron to acquire more stable Ce^{3+} state. $La(OH)_3$ is the most basic among lanthanide hydroxides.

39. **(a)** When $AgNO_3$ reacts with PH_3, then Ag is obtained.

$\underset{\text{silver nitrate}}{6AgNO_3} + \underset{\text{phosphene}}{2PH_3} \longrightarrow 6Ag + \underset{\text{phosphorous acid}}{2H_3PO_3} + 6NO_2$

40. **(c)** I^- is converted to IO_3^- by neutral or faintly alkaline MnO_4^- as shown below.

$2MnO_4^- + H_2O + I^- \longrightarrow 2MnO_2 + 2OH^- + IO_3^-$

41. **(c)** The transition metals and their compounds are used as catalysts. Because of the variable oxidation states they may form intermediate compound with one of the readtants. These intermediate provides a new path with lowe activation energy. $V_2O_5 + SO_2 \rightarrow V_2O_4 + SO_3$

$2V_2O_4 + O_2 \rightarrow 2V_2O_5$

42. **(b)**

43. **(a)** The basic character of the transition metal monoxide is $TiO > VO > CrO > FeO$ because basic character of oxides decrease with increase in atomic number. Oxides of transitional metals in low oxidation state i.e., +2 and +3 are generally basic except Cr_2O_3.

44. **(b)** After crystal field spliting, the five d-orbitals. get separated as three t_{2g} and two orbitals. For Mn^{2+}, last shell has 5 e^-s i.e., $3d^5\,4s^0$. So according to Hund's rule of maximum multiplicity the excited state configuration will be $t_{2g}^3 e_g^2$.

45. **(a)** $2K_2CrO_4 + 2HNO_3 \rightarrow K_2Cr_2O_7 + 2KNO_3 + H_2O$

$\Rightarrow 2CrO_4^{2-} \underset{}{\overset{H^{\oplus}}{\rightleftharpoons}} Cr_2O_7^{2-} + H_2O$